Aviation Weather Center:

Products & Services Overview
Utility of Ensemble Model Guidance

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Chicago Aviation Weather Workshop

February 25, 2011

Support for the FAA

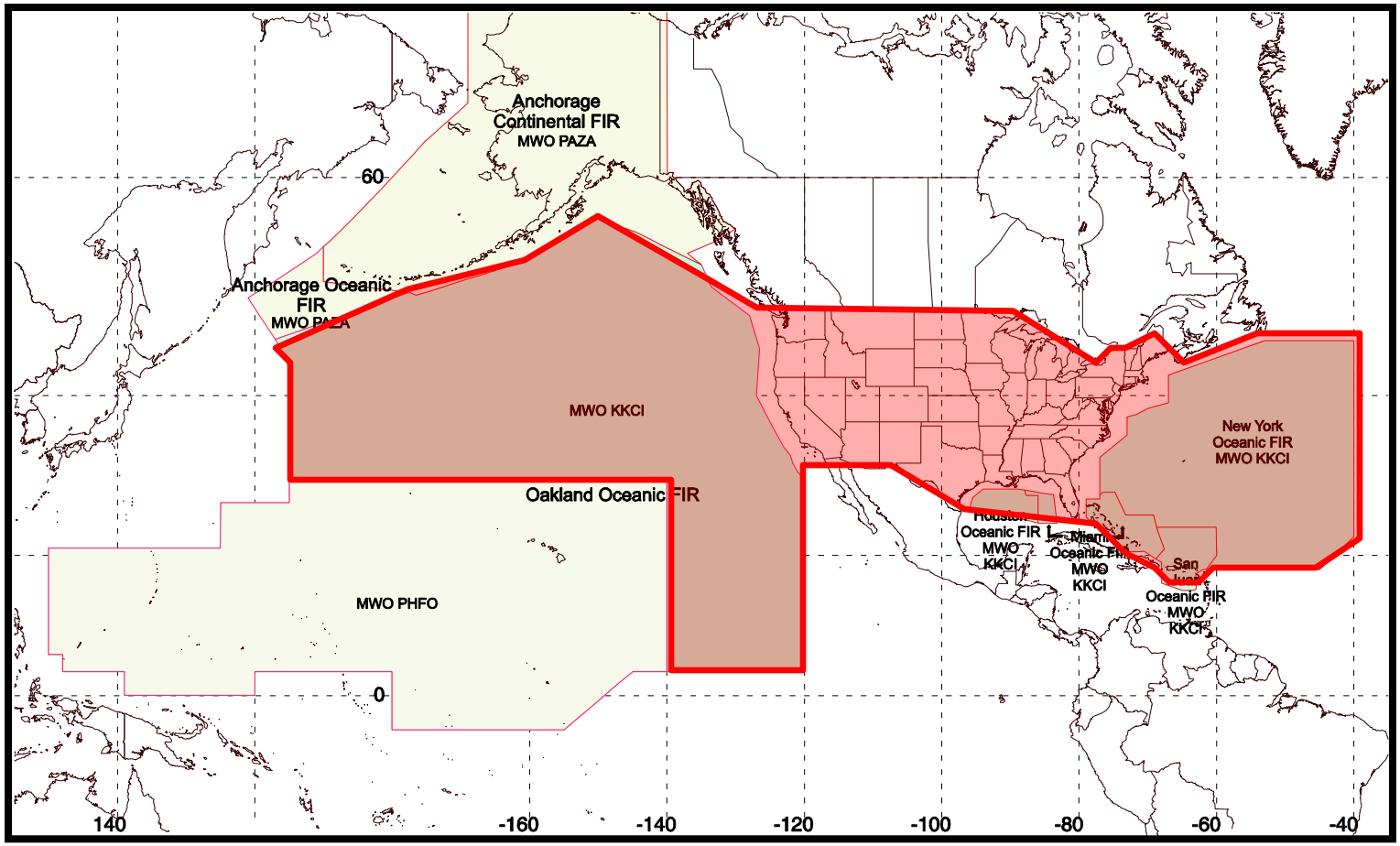
FAA – *Gives NWS requirements for products/services*

- System Ops
  - CCFP
    No cost to FAA
  - CWSU
- Flight Standards
- Flight Safety
  - ADDS
  - SIGMET
  - AIRMET
  - Area Forecast
  - Sig Wx Low
  - Winds Aloft
  - TAF
  - “Red Book” Gx

  No cost to FAA
- ICAO/WMO
  - WAFS SIGWX
  - Intl. SIGMETs
  - IFFDP

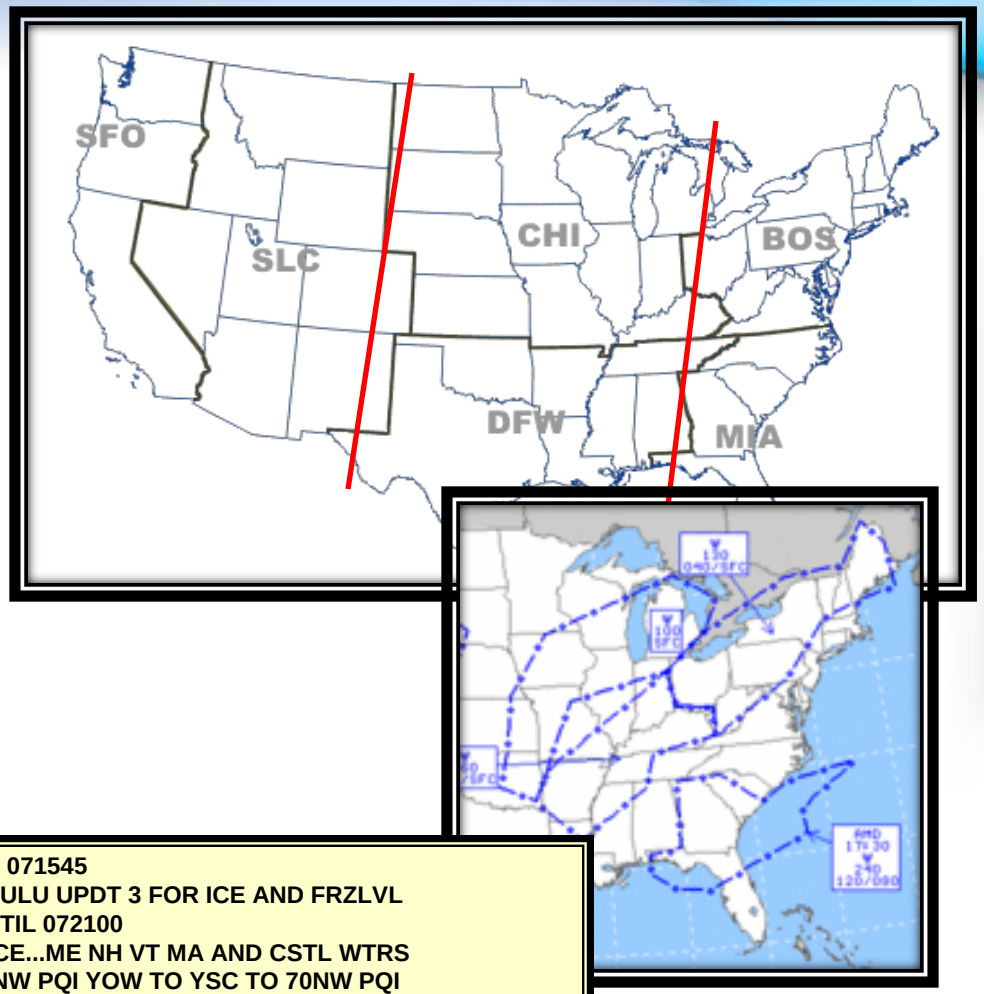
  No cost to FAA

AWC's Area of Responsibility for Aviation Warnings (SIGMETs)



SIGMET, AIRMET & Area Forecast

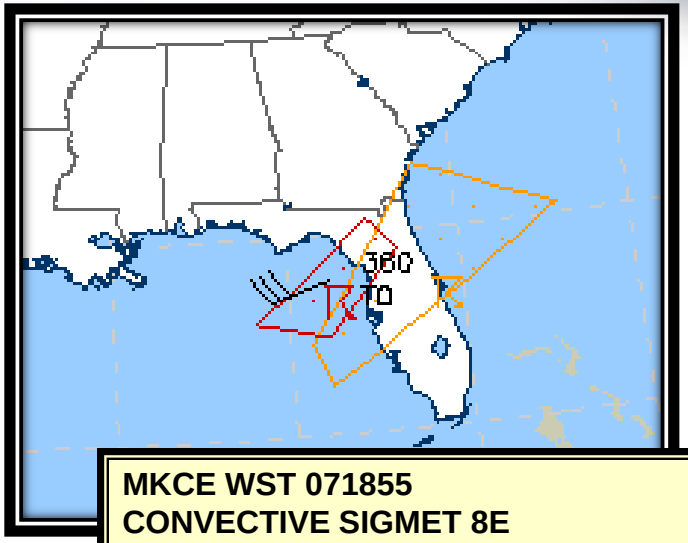
- 3 Forecast Desks 24/7
  - CONUS & Coastal Wtrs
- Graphic & Text Forecasts
  - AIRMETs
    - 26280 routine issues/yr
  - FA
    - 6570 routine issues/yr
  - SIGMET (non Convective)
    - ~ 500 avg. annual
  - Low-Level Graphic
    - 1456 routine issues/yr



BOSZ WA 071545
AIRMET ZULU UPDT 3 FOR ICE AND FRZLVL
VALID UNTIL 072100
AIRMET ICE...ME NH VT MA AND CSTL WTRS
FROM 70NW PQI YOW TO YSC TO 70NW PQI
MOD ICE BTN FRZLVL AND 140. FRZLVL SFC-040. CONDS
CONTG BYD 21Z THRU 03Z.

Convective SIGMET

- 1 Forecast Desk 24/7
- SIGMET for thunderstorms
  - "Warning" Product
  - Associated Hazards: Turbulence, Icing, & Wind Shear
- CONUS and coastal waters
- Issued Hourly / Valid for 2 hrs
- ~ 30,000 issued annually

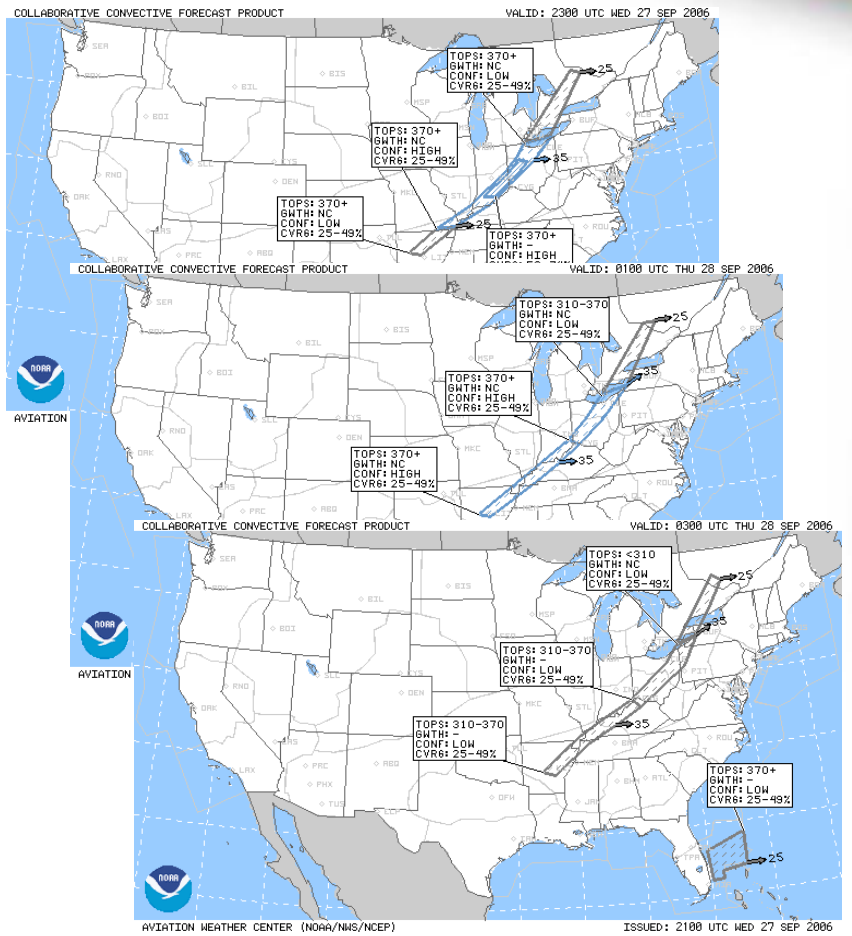


MKCE WST 071855
CONVECTIVE SIGMET 8E
VALID UNTIL 2055Z
FL AND CSTL WTRS
FROM 40NNE CTY-30N OMN-70WSW PIE-170W PIE-40NNE CTY AREA EMBD TS MOV FROM 27020KT. TOPS TO FL350. REF INTL SIGMET CHARLIE SERIES.

OUTLOOK VALID 072055-080055
FROM 30N CRG-190ENE OMN-100SW SRQ-100WSW PIE-30N CRG
WST ISSUANCES POSS. REFER TO MOST

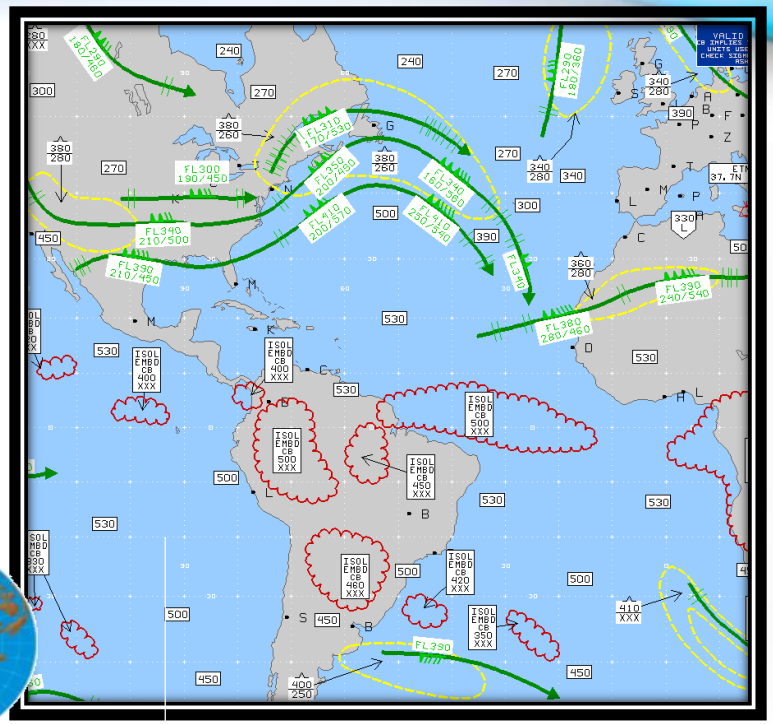
Collaborative Convective Forecast Product (CCFP)

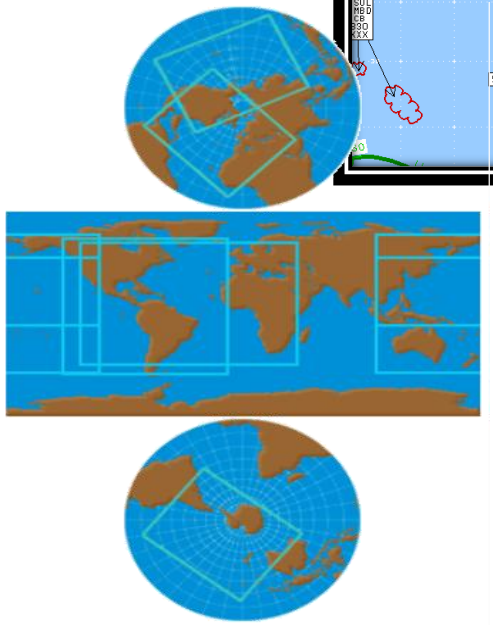
- 1 Forecast Desk 20/7
- Strategic traffic flow management
- Collaborators:
  - FAA
  - Meteorologists at CWSUs, Airlines, and AWC
  - Canada
- ~ 25,000 Forecast Polygons annually



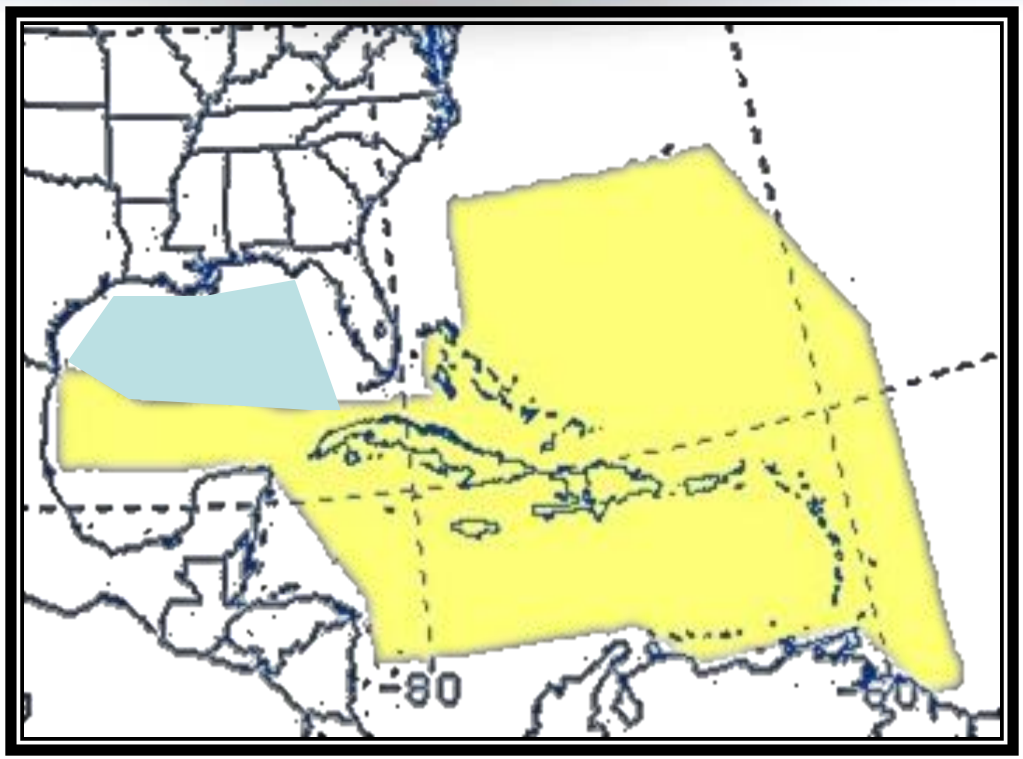
Significant Weather Fcsts

- 2 Forecast Desk 20/7
  - Covers FL250 - FL630
  - Global forecast
- 24 hour forecast:
  - Jet Streams
  - Thunderstorms
  - Turbulence
  - Tropopause Heights
  - Active Volcanoes
  - Tropical Cyclones
- 18,980 routine issuances/yr





Gulf of Mexico & Caribbean



- 1 Forecast Desk 24/7
- Oceanic (Atlantic and Pacific) SIGMETs
- Weather Forecasts primarily for Helicopter Operations
  - Clouds
  - Visibility
  - Thunderstorms
  - Rain/Fog
  - Wind

- 4,000 Operating Oil Platforms
- 30,000 personnel living on oil platforms
- 600 Helicopters
- 1.3 Million flights annually

World Area Forecast Center

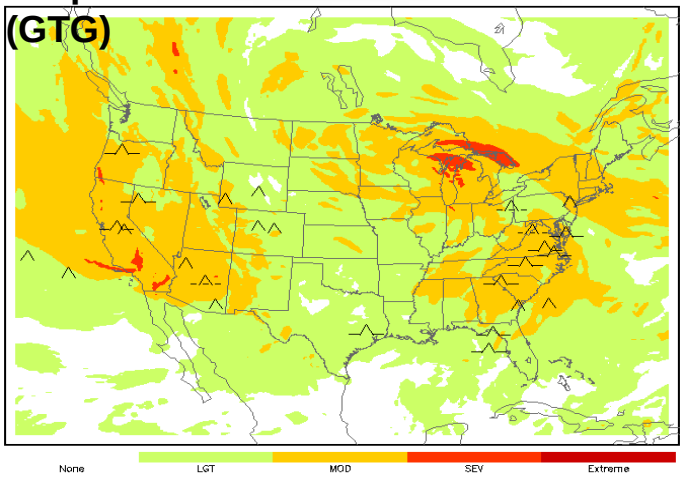
- **World Area Forecast System (WAFS)**
  - **Formulated by International Civil Aviation Organization and the WMO**
  - **Improve the quality and consistency of enroute guidance provided for international aircraft operations**
- **World Area Forecast Centers (WAFC)**
  - **WAFC – Washington**
    - AWC provides Significant Weather Forecasts
    - NCEP Central Operations Provides Wind and Temperature Grids Charts
    - NWS Telecommunications Gateway supports satellite data broadcasts
  - **WAFC – London**
    - Met Office – Exeter

AWC Product Issuances

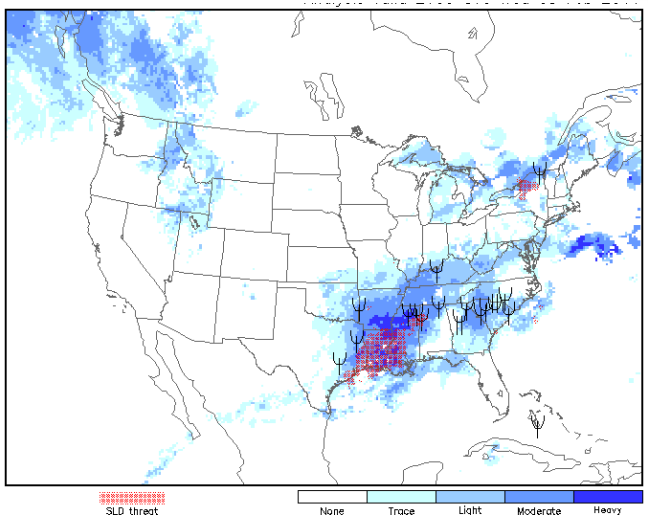
Product	#/Year
Convective SIGMET	~30,000
Non-Convective SIGMET	500
Collaborative Convective Forecast Product (CCFP)	25,000
AIRMETs	26,280
Area Forecasts (FA)	6,570
Significant Weather Low	1,456
Significant Weather High	18,890

Operational Automated Products

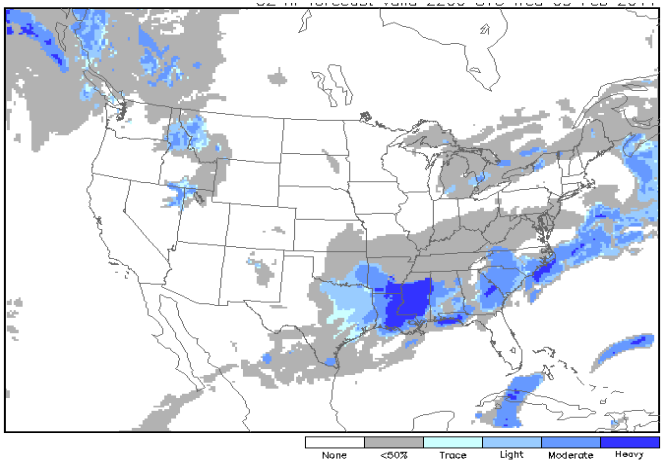
Graphical Turbulence Guidance (GTG)



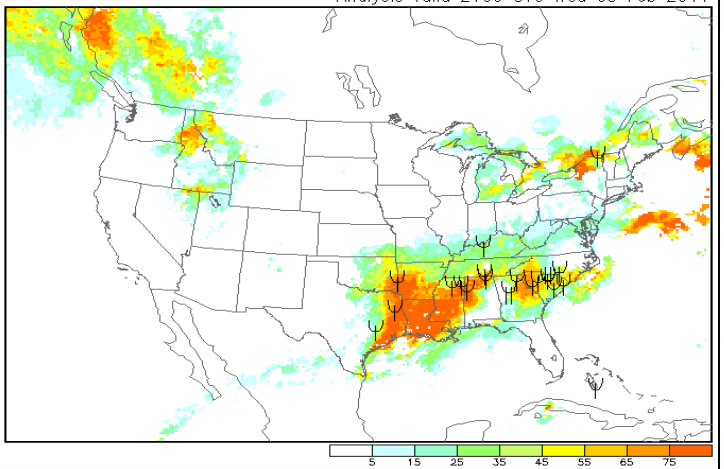
Current Icing Product (CIP)



Forecast Icing Severity (FIS)



Forecast Icing Probability (FIP)



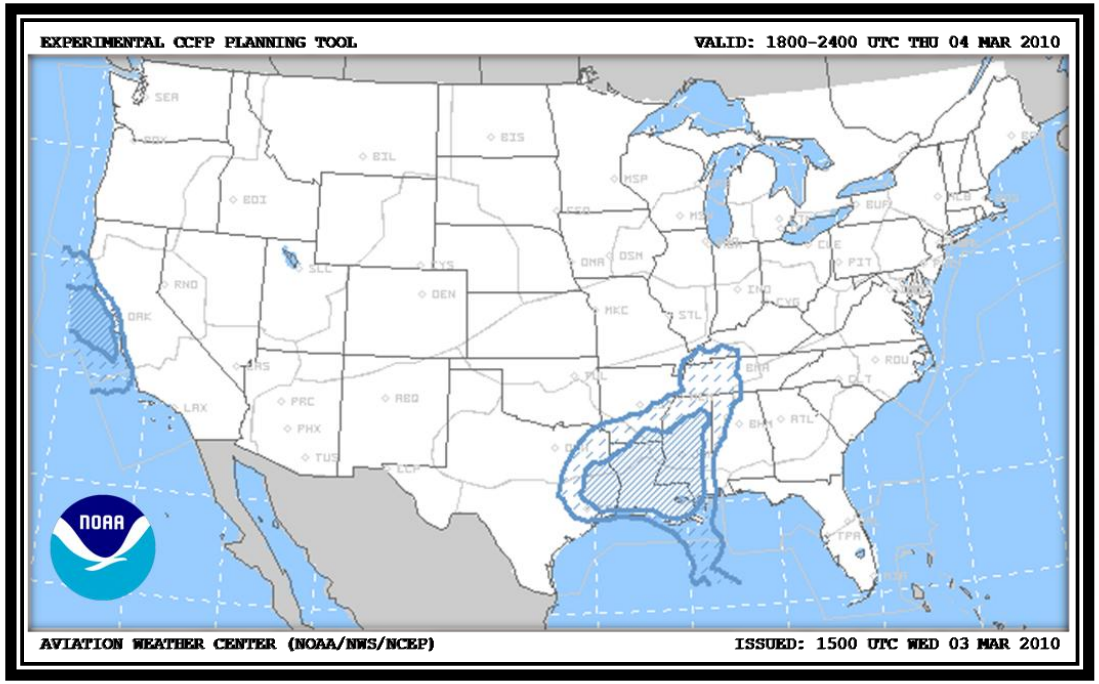
@adds

- Aviation Digital Data Service (ADDS) makes available to the aviation community text, digital and graphical forecasts, analyses, and observations of aviation-related weather information
- Meets FAA requirements for "Qualified Internet Communications Provider"
  - Allows operational use by part 121/135 operators (airlines)
- Not just a web display
  - Is a dynamic database
- Already has many NEXTGEN data service capabilities
- ADDS joint developed
  - NCAR, GSD, and AWC
- Operational Since 2003
- Averaging
  - 9 million hits per day
  - 100 GB per day

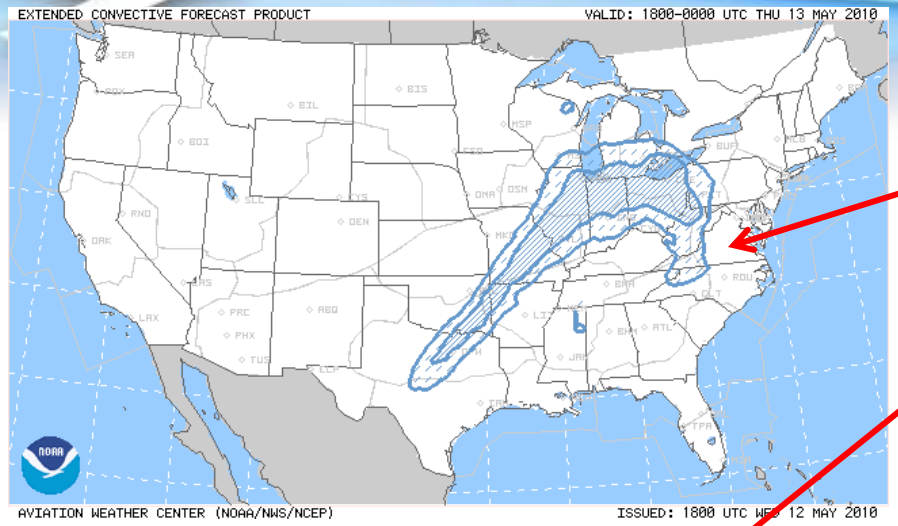
New Products – Looking Toward NextGen

Extended Convective Forecast Product (ECFP)

- Valid 18-00Z tomorrow
- Depicts 40, 60, 80% probability of thunder
- Uses CCFP "look and feel"
- Quick look at where tomorrow's main impact will be



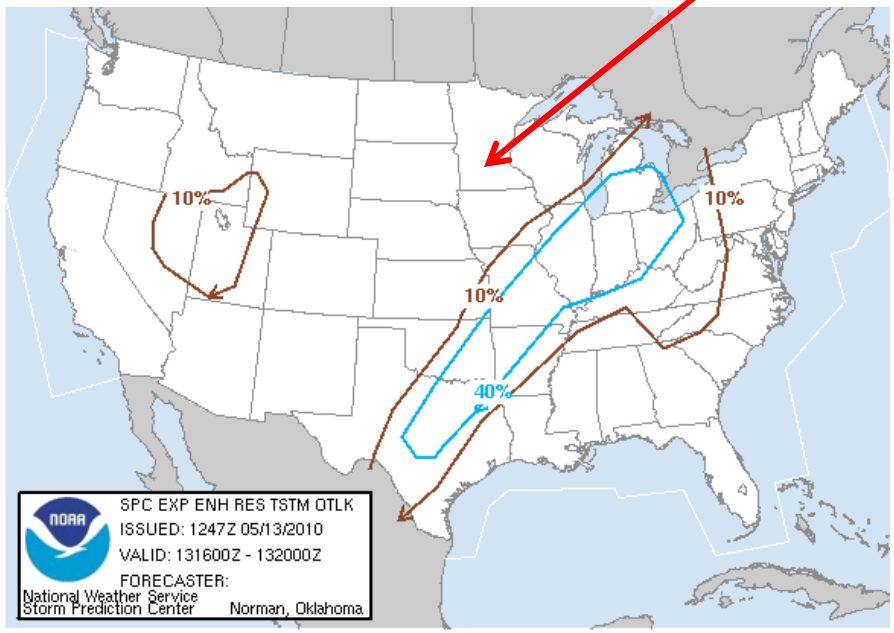
ECFP + SPC + AWC = Consistency

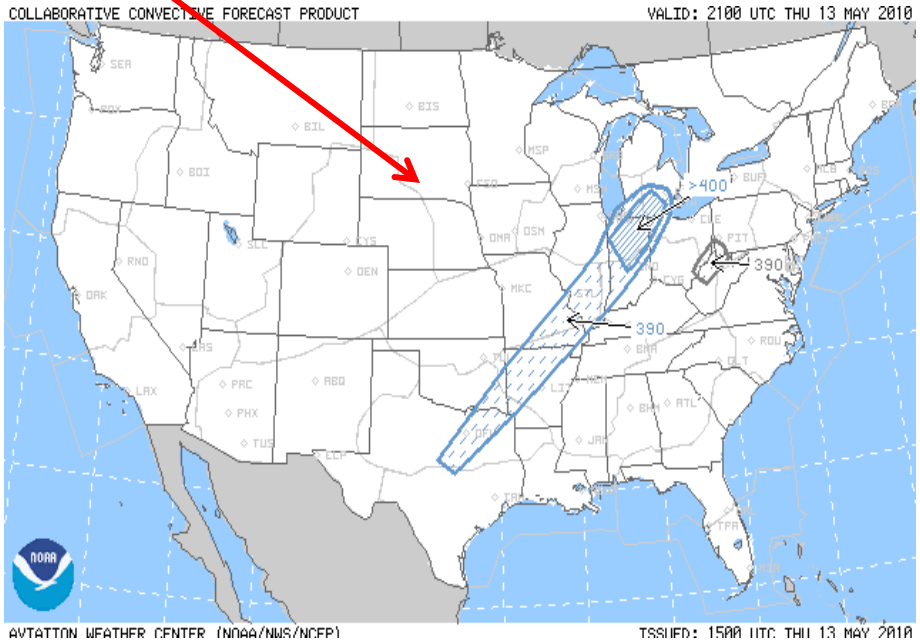


Automated based on SREF Prob 26hr in advance

Partially automated based on SREF 9hr in advance

6hr CCFP



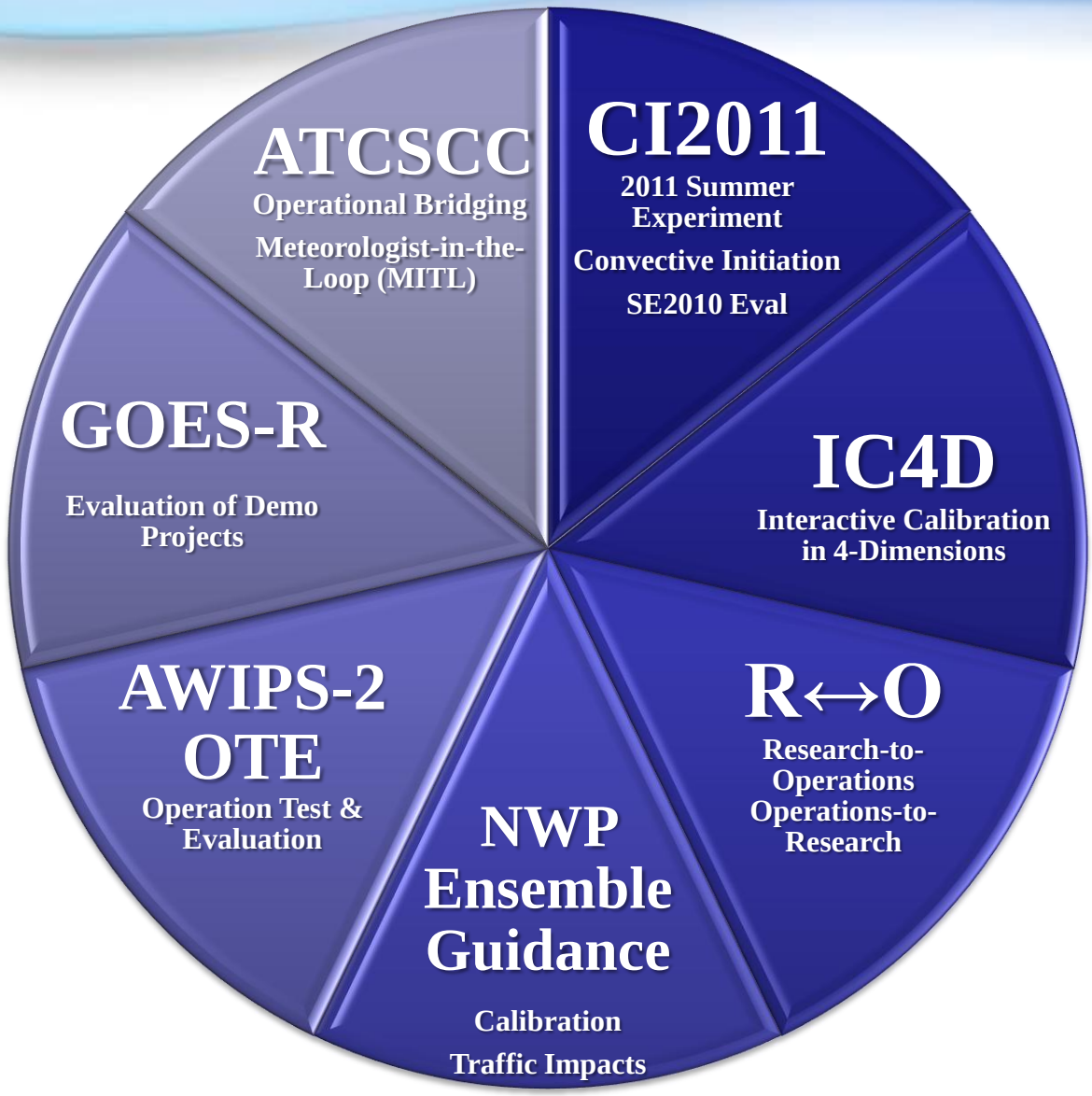


Aviation Weather Testbed

AWT Science Support

- The AWC, with external partners and stakeholders, is increasing internal scientific research for aviation weather via the AWT
- Focus on creating tools for forecasters to use within NextGen era
- Basic research on NWP data: post-processing, probabilistic, calibration, high resolution, ensembles, convection
- Visualization development via AWIPS II and IC4D

AWT Projects



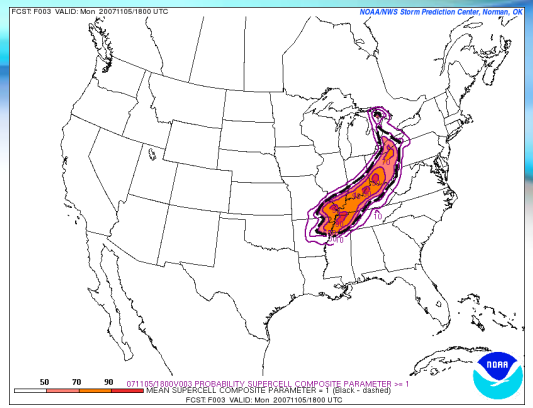
Ensemble Guidance at AWC

- Develop specialized guidance for the specific application (convection and other aviation weather hazards)

- Design guidance that…
  - **Help blend deterministic and ensemble approaches**
  - **Provide guidance for uncertainty/probabilistic forecasts**
  - **Provide guidance that aids confidence (i.e., better deterministic forecasts)**
  - **Illustrates plausible scenarios**
  - **Allows for diagnostic analysis – not just a statistical black-box**

Ensembles Available at AWC: SREF

NWS/NCEP Short Range Ensemble Forecast (SREF)

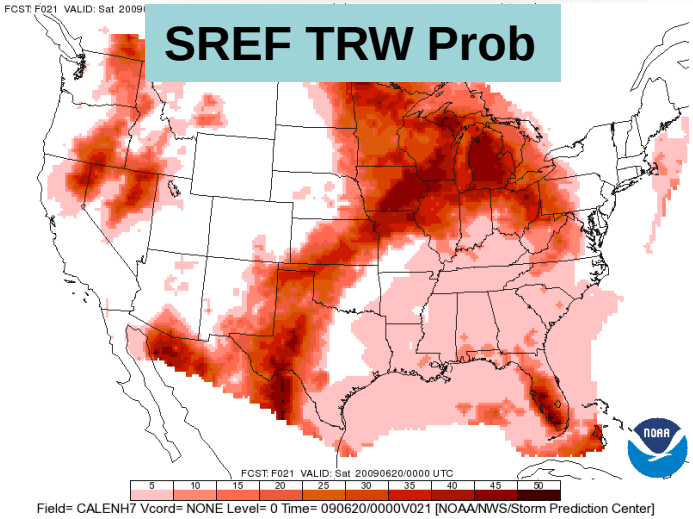


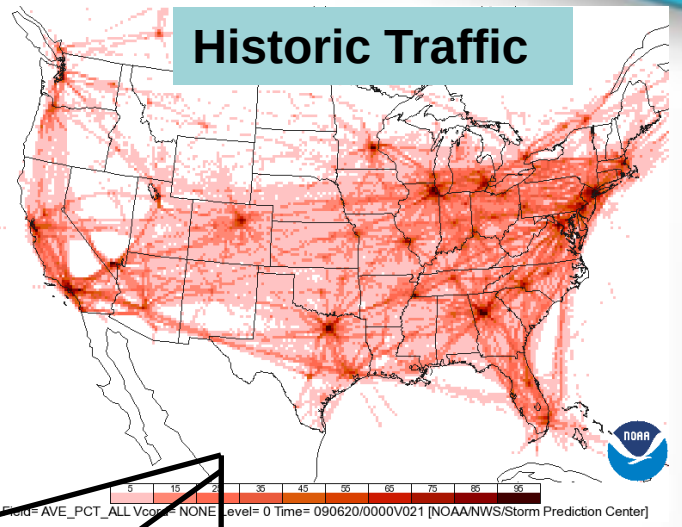
- **EMC SREF system (21 members)**
  - **87 hr forecasts four times daily (03, 09, 15, 21 UTC)**
  - **North American domain**
  - **Model grid lengths ~32 km**
  - **Multi-model: ETA (6), RSM (5), WRF-NMM (5), WRF-ARW(5)**
  - **Multi-analysis: NAM, GFS initial and boundary conds.**
  - **IC perturbations and physics diversity**
  - **Recently added bias-correction to some fields**

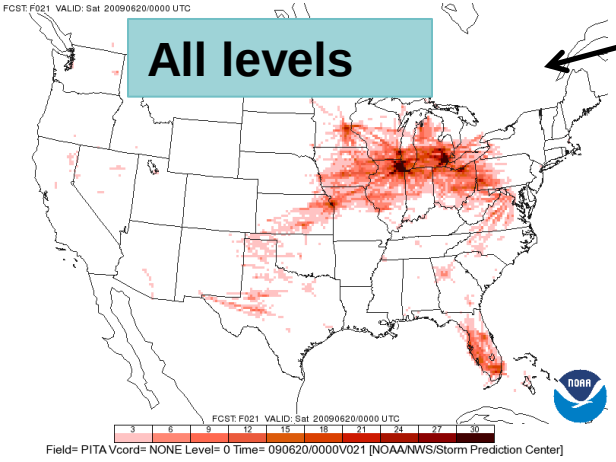
NATIONAL CENTERS FOR ENVIRONMENTAL PREDICTION
NCEP

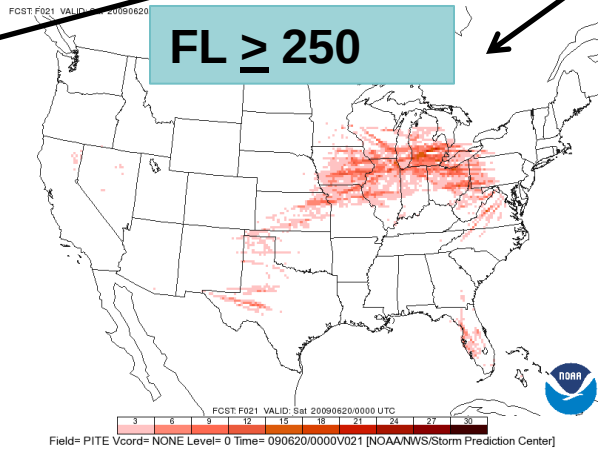
Storm Prediction Center
Norman, Oklahoma

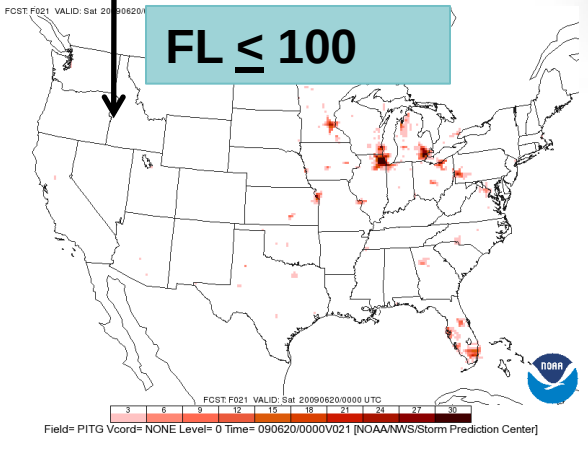
Aviation Impact Guidance for Convective Weather (AIGCW)





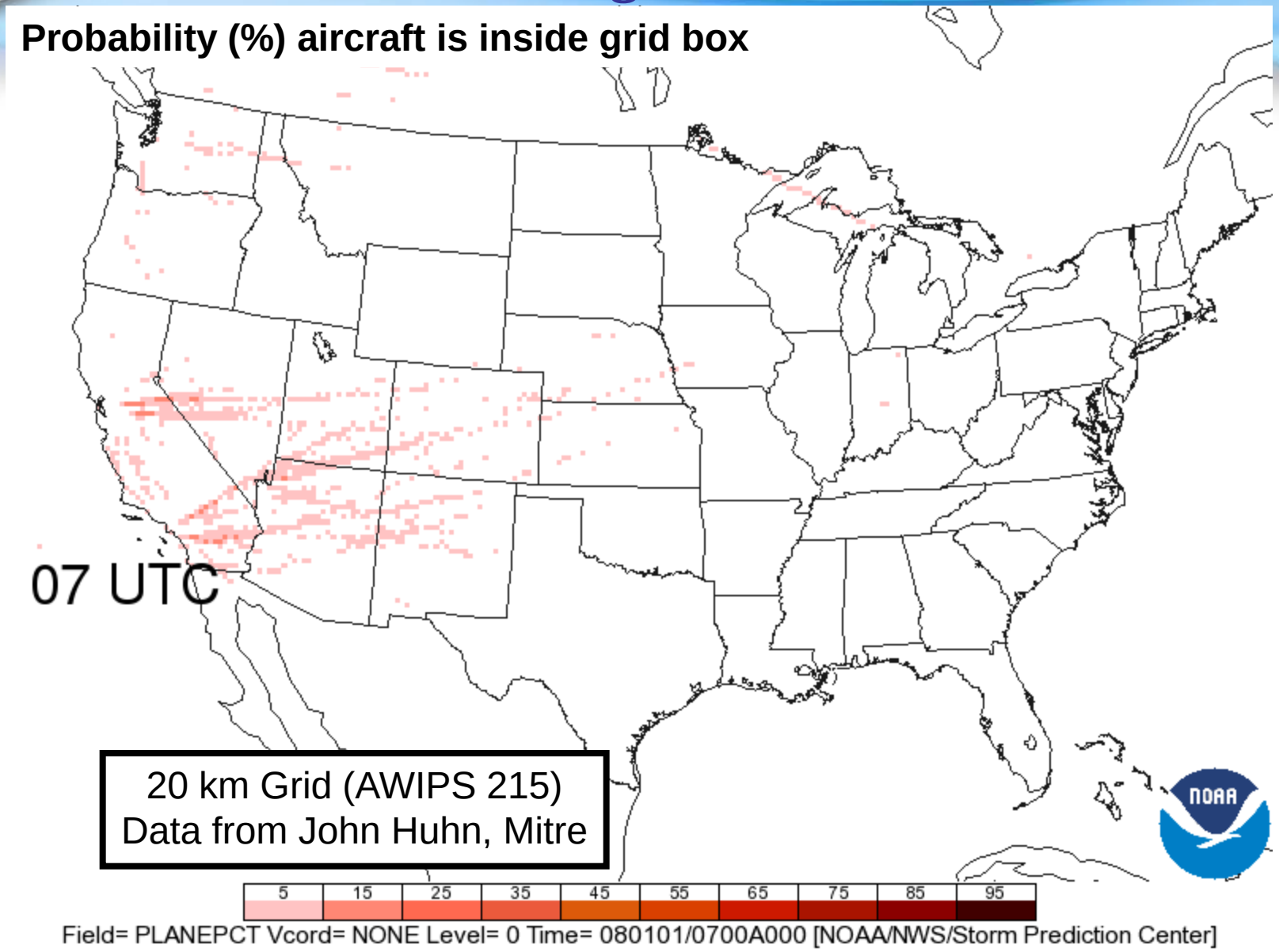




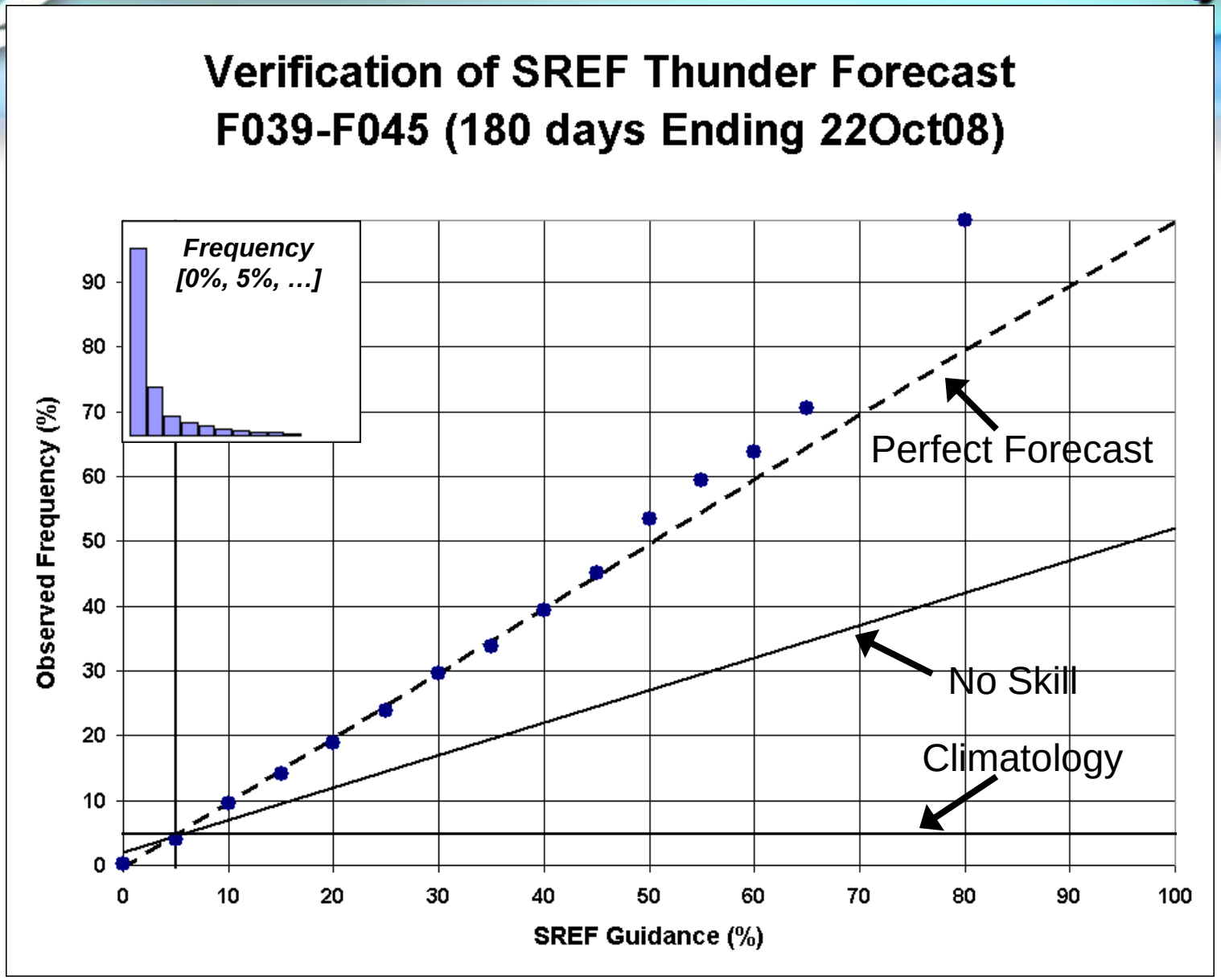


Gridded Flight Composite (20 km)

December 2007 to August 2008 – Above 250 KFT

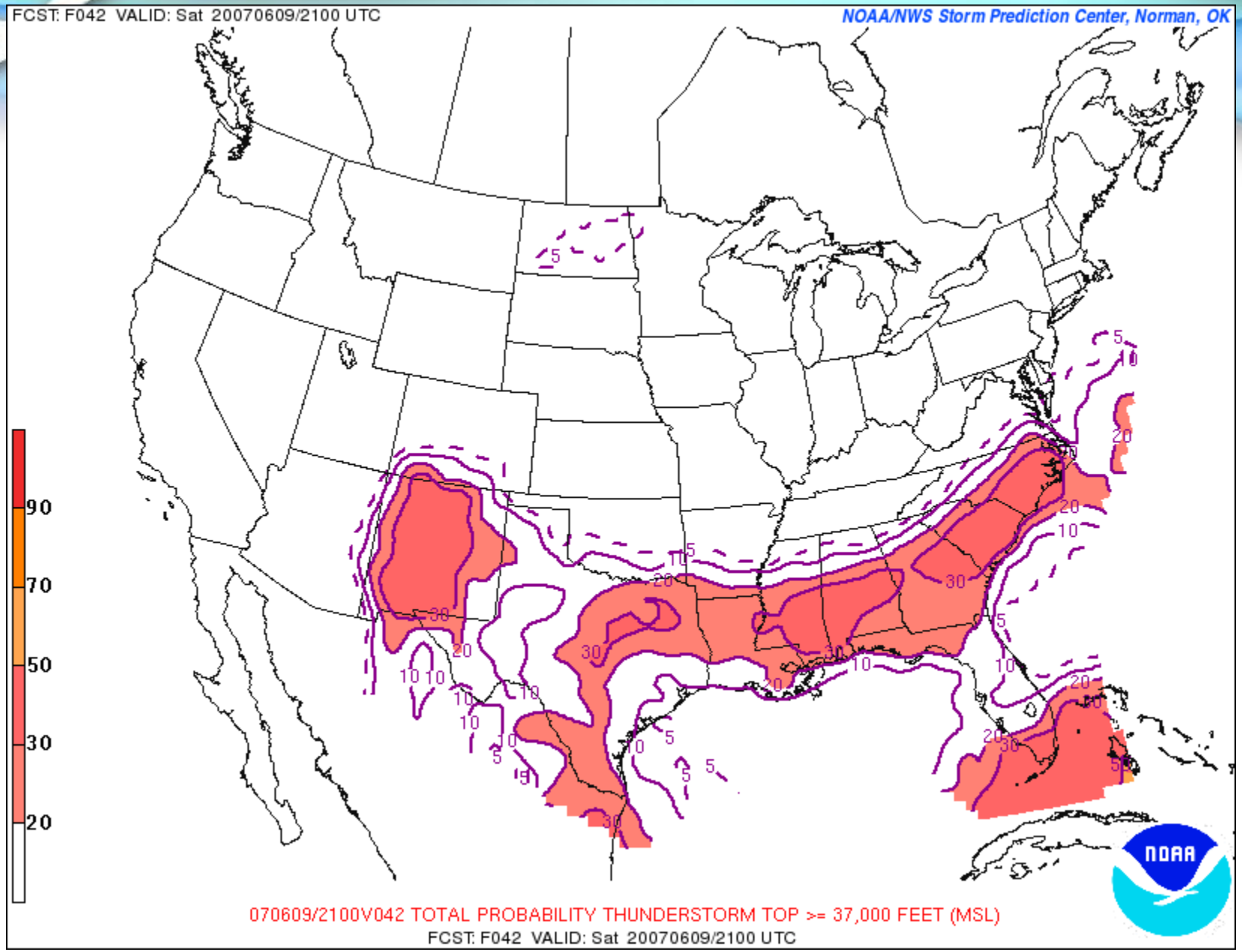


Calibrated SREF Thunder Reliability



Calibrated Thunder Probability

SREF Probability Convective Cloud Top ≥ 37 KFt



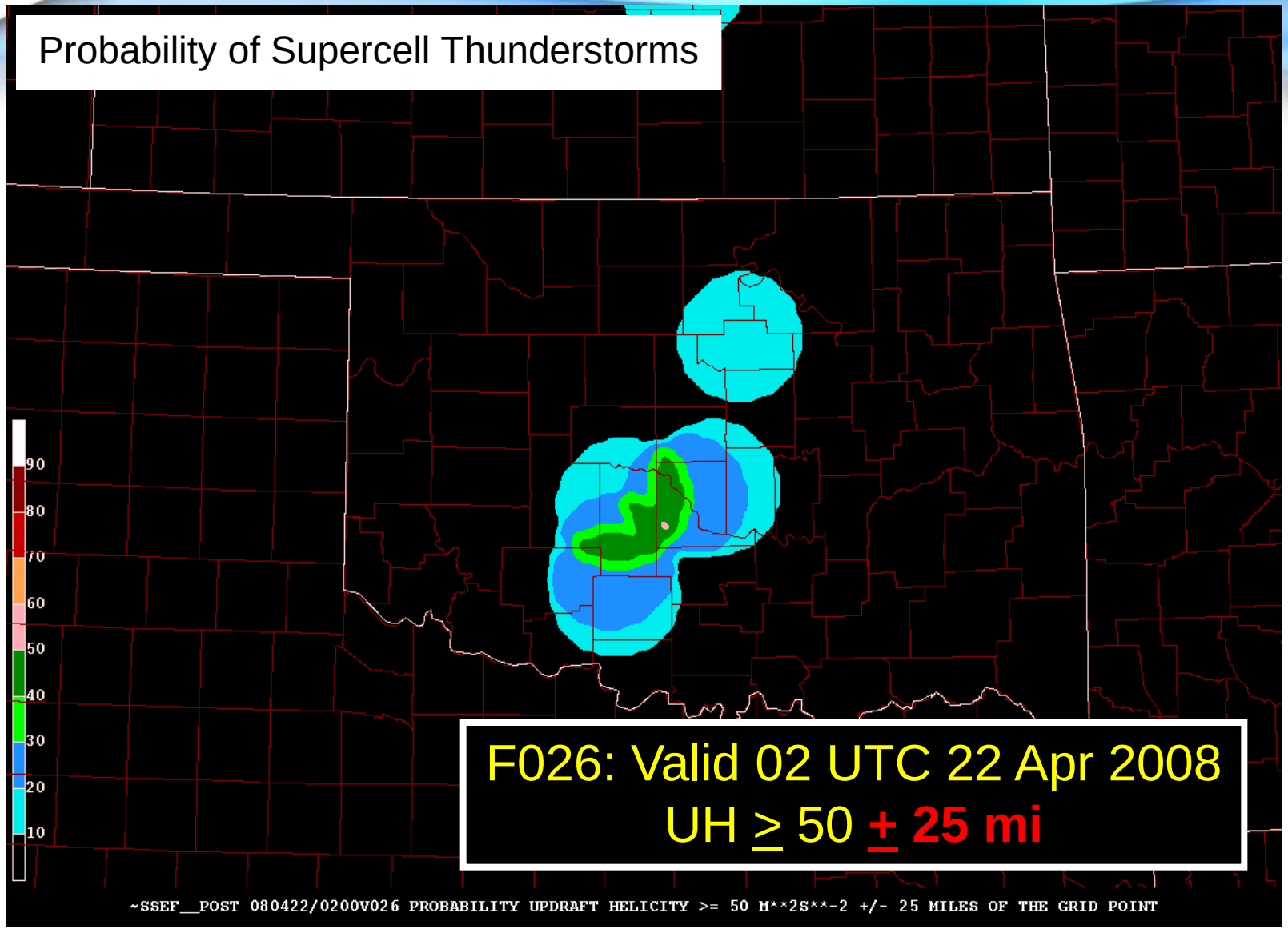
Ongoing Activities

- Future Aviation Ensemble Applications
  - **Applications and calibration under development**
    - One hourly SREF CCFP guidance (through F036) *****
    - Calibration of potential impacts of convection in SREF ^
    - Rapid Refresh Ensemble Forecast (RREF) – 1hr updates, RUC based *****
    - Storm scale (e.g., supercells, squall lines) applications being evaluated

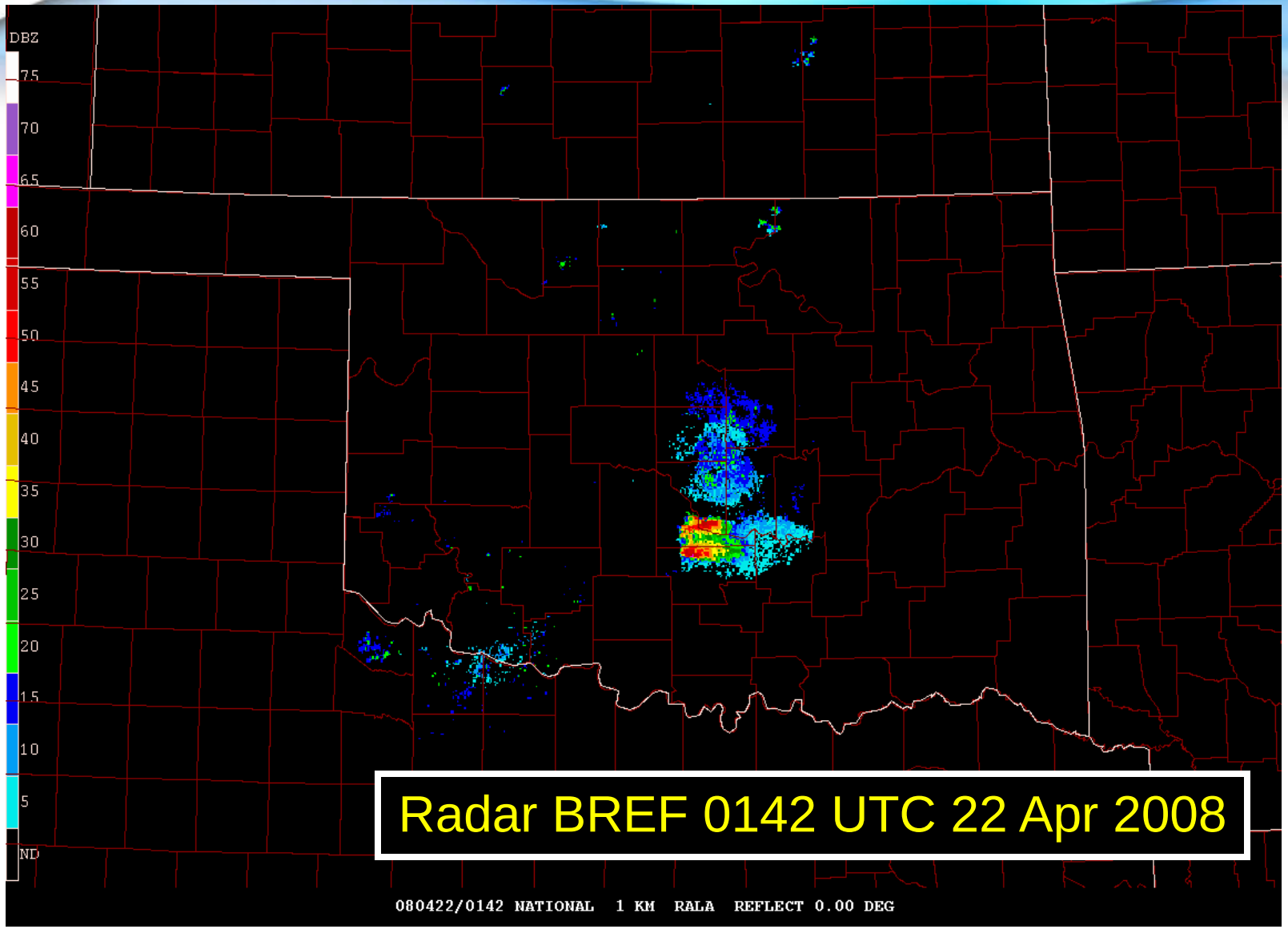
**Not discussed today*

^Collaborating with John Huhn, Mitre Corp.

Probability Updraft Helicity $\geq$ 50 m^2/s^2



Observed Radar



Probability Updraft Helicity $\geq$ 50 m^2/s^2

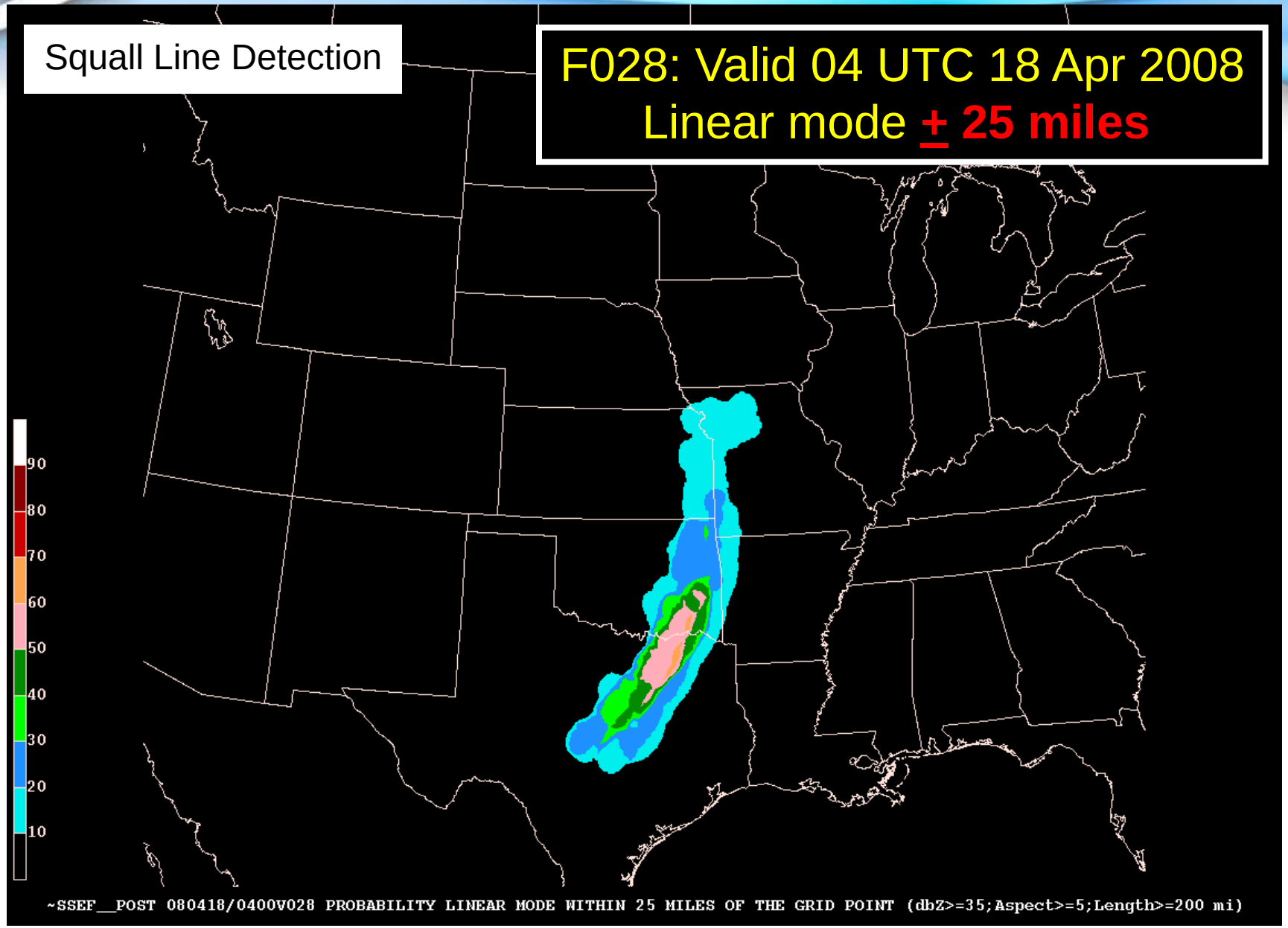
View of the left split looking south from Norman, OK (0145 UTC 22 Apr 2008)

(Numerous large hail reports up to 2.25")

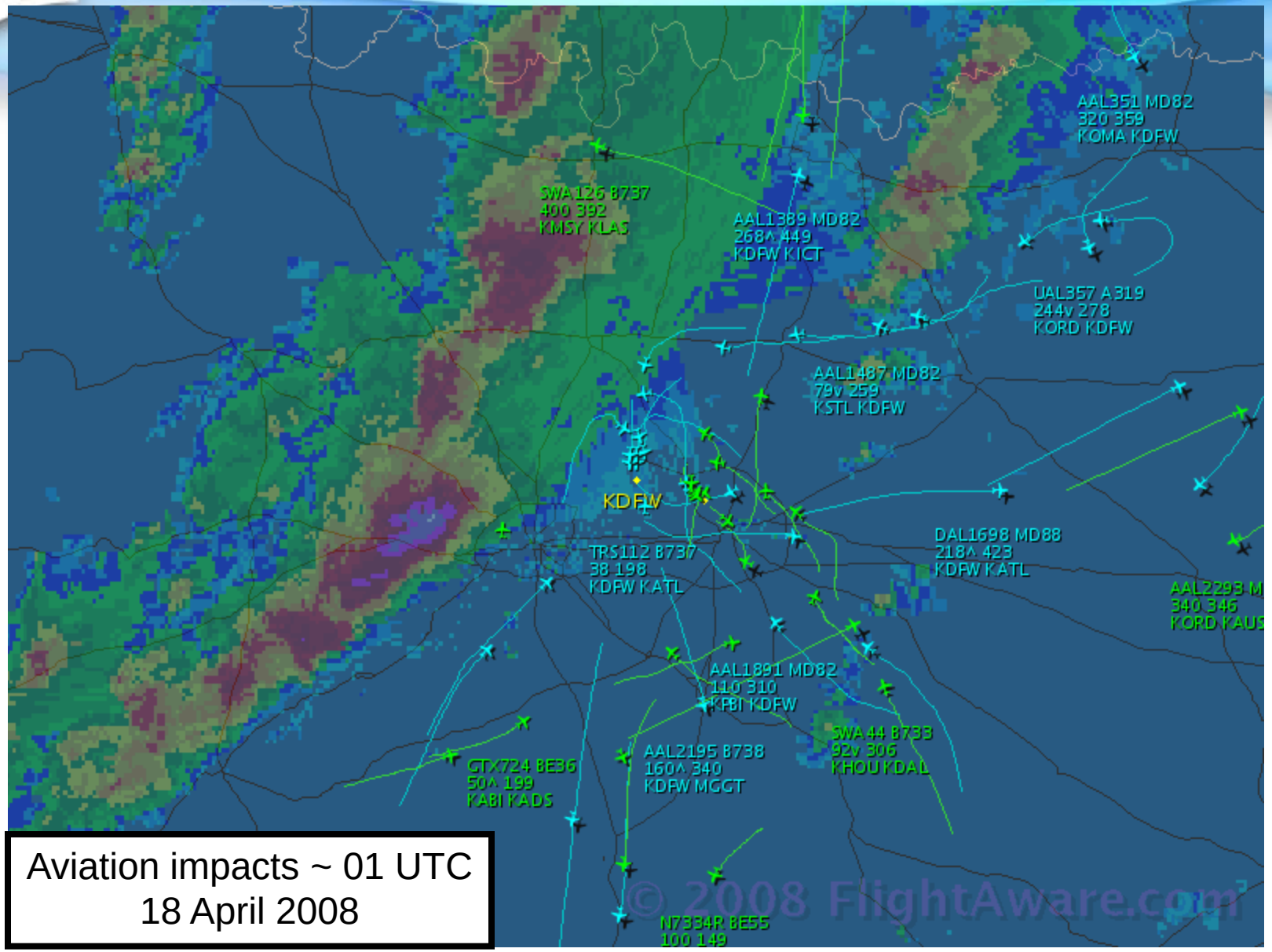
Convective Mode: Linear Detection

- Determine contiguous areas exceeding 35 dbZ
- Estimate mean length-to-width ratio of the contiguous area; search for ratios $\geq$ 5:1
- Flag grid point if the length exceeds:
  - 200 miles

Probability Linear Mode Exceeding 200 miles



Linear Convective Mode: Impacts



Aviation impacts ~ 01 UTC
18 April 2008

Image provided by Jon Racy

Summer 2011 Experiment

- Partnership with Department of Defense (AFWA)
- 10 member 4km WRF ensemble
- Focus on developing tools for identifying aviation impacts
- Mid-June to Mid-July
- Stationed at the Aviation Weather Testbed
- Convective initiation theme
- Other models/data: HRRR, CoSPA, LAMP

Summary

- AWT is evolving to include more local scientific research in support of AWC mission
- Strong partnerships are developing between academic, government, and private industry
- Continue broad interaction on convective initiation problems with other Testbeds
- Focusing on ensemble guidance for decision support
  - 2011 Thunderstorm Impact Experiment